Patented Dec. 20, 1938

2,140,627

UNITED STATES PATENT OFFICE

2,140,627

ENGINE FUEL

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No Drawing. Application May 15, 1936, Serial No. 79,961

8 Claims. (Cl. 44—9)

This invention relates to improvements in the art of manufacturing liquid fuels of the type adapted to use in automotive engines and the like. More particularly, the present invention relates to the production of stable liquid fuels of the anti-knock type, especially adapted to use in stationary and portable high compression internal combustion engines and those used in automobiles.

It has been conventional practice in the past, in the manufacture of so-called anti-knock fuels or gasolines, to incorporate in an ordinary straight run gasoline a certain amount or proportion of one of several anti-knock agents. The anti-knock agent has been added directly to the gasoline, then the components have been churned up together until thoroughly mixed, and the fuel was then passed, either to tank cars, for distribution, or to storage tanks, pending distribution.

One of the so-called anti-knocking agents proposed to be used to enhance the quality of straight run gasoline as a fuel for high compression internal combustion engines, is iron pentacarbonyl. Under laboratory conditions of investigation, iron pentacarbonyl seemed to have several desirable qualities for the purpose intended. Tests in automotive laboratories have indicated that this material, when associated with ordinary straight run gasoline, possesses the capacity to increase the octane value thereof, and reduce the tendency of knocking in the high compression engine in which the gasoline, so treated, is used.

From the commercial point of view, however, and it is this point to which the present invention particularly is directed, iron carbonyl became relegated to that class of chemicals, frequently known as laboratory curiosities. Although the material seems to work quite well in the laboratory, still the anti-knock gasoline produced with the material loses its advantageous qualities after a relatively short period of time, with the result that it has been virtually impossible simply to incorporate iron pentacarbonyl into gasoline at one locality and expect the treated gasoline to function properly and completely at a distant locality.

It must be borne in mind in the consideration of the invention herein disclosed, that appreciable periods of time elapse from the time of manufacture of gasoline to the time of use, despite the facilities and rapidity of modern transportation systems. Gasoline produced at the oil refinery, even if passed directly to tank cars, may stand twenty-four hours or more before being moved on the tracks. At the point of destination, the fuel probably will be transferred to tanks awaiting tank truck distribution to filling stations. Or, even if the fuel is transferred to the underground tanks at the filling stations, it may stand three or four days before being dispensed to the consumer. This condition particularly is true in rural districts.

One of the principal disadvantages from the use of iron carbonyl in a liquid motor fuel, such as gasoline or the like, has been the tendency of iron carbonyl to form a bulky precipitate upon long standing, or upon exposure of gasoline containing iron carbonyl to air and/or sunlight. This change in the condition of the iron carbonyl upon standing or upon exposure to air and/or sunlight not only lowers the anti-knock value of the gasoline from that originally imparted to it by the freshly dissolved iron carbonyl, but also renders the gasoline unsuited for use as a motor fuel because of the liability of the precipitated product to clog the gasoline line, carburetor, or the like.

Otherwise expressed, the iron carbonyl loses its anti-knock function in the fuel because of its tendency to change chemically and become immiscible with the fuel. This deterioration in quality continues as time elapses.

This invention resides in the concept and determination that a high quality gasoline substantially permanently retaining its anti-knock characteristics, is prepared easily from ordinary relatively inexpensive low octane value gasoline by incorporation therewith of small amounts of iron carbonyl and a peptizing agent. According to the present invention, anti-knock fuels are provided by associating the iron carbonyl with a peptizing agent comprising a soap, or soap-like substance. The precise chemical action of the peptizing agent is not clearly understood, but the results evidence the fact that the iron carbonyl remains in solution substantially permanently without being affected by exposure to air or sunlight.

As the base fuel from which the high quality anti-knock fuel of the present invention is prepared, a variety of liquid motor fuels are suited to use. Among these may be mentioned straight run or cracked gasoline, or blends thereof, likewise blends of so-called "polymer" gasoline and blends of gasoline with benzol, alcohol, and the like. Of course, it will be understood that low compression gasolines, which have an octane value of about 60 or less, inherently are those

most desirable to treat in accordance with the present invention, by reason of the fact, first, that these are the gasolines most needful of improvement in quality, and secondly, these are the gasolines usually cheapest in cost and most available.

Broadly speaking, the peptizing agent for effecting permanence of the anti-knock quality of gasoline treated with iron carbonyl may be said to comprise a composition, first: which does not permit degradation or decomposition of the iron carbonyl; secondly, a composition substantially stable in and of itself; thirdly, a material substantially miscible with or dissoluble in the fuel with which it is to be associated so that it will not settle or separate therefrom during the time that the treated fuel is awaiting actual use, and, preferably, fourthly, a composition efficient with respect to peptization of the iron carbonyl in the fuel, so that only small quantities of it need be used.

It is within the concept of the invention, of course, that the peptizing agent be innocuous with respect to use in internal combustion engines; that is to say, substantially chemically inert with respect to the parts of the engine with which the fuel comes into contact, and likewise free of any tendency to cause sticking, clogging or gumming of the parts of the engine, for example, the rather delicately adjusted control mechanisms in the carburetor.

Although iron carbonyl is quite soluble in gasoline and blends thereof, it has a tendency, as previously noted, to come out of solution and form a precipitate upon long standing, and particularly upon exposure to air and/or sunlight. I have now found that this tendency can be largely reduced, or even entirely eliminated, by incorporating a soap, or a soap-like composition, into the liquid motor fuel along with the iron carbonyl. The protective action of the soap or soap-like composition does not appear to be due to the emulsifying or detergent properties of the soap, since there is, of course, no aqueous medium present to require emulsification and since the iron carbonyl is truly soluble by itself in gasoline and blends thereof. It may be that the action is a protective colloid action or it may be due to a more favorable adjustment of the pH value of the liquid fuel by the soap or soap-like composition added thereto.

The term "soap" as herein used includes the metal, ammonium and substituted ammonium compounds of fatty acids. Examples of substituted ammonium compounds of fatty acids are the alkylol amine compounds, such as triethanolamine oleate, and the like.

I have also found that the addition of free fatty acids or their glycerides to the mixture of iron carbonyl and a soap, or soaps, gives additional advantages and renders the mixture more stable upon the addition to liquid motor fuels. Although oleic acid and its glycerides are preferred examples of the fatty acids and fats that can be used to advantage in my composition, it will be understood that other fatty acids and fats can be employed. The use of a fatty acid or fat is particularly advantageous when the soap employed is not entirely soluble in the liquid fuel to give a clear solution. In that case, the addition of free oleic acid, or glycerides thereof, such as sperm oil, olive oil, lard oil, and the like, act to clear up the solution.

I have also found that esters of polyhydric alcohols and fatty acids can be used with a soap, or mixture of soaps, either in place of or in addition to free fatty acids and fats, to increase the solubility of the soap, or soap mixture, in the liquid fuel and render the fuel and its iron carbonyl content more stable. Examples of esters of polyhydric alcohols and fatty acids are the glycol esters of the fatty acids, such as diglycol laurate. This compound by itself gives a somewhat cloudy solution in gasoline but when combined with triethanolamine oleate dissolves to a clear solution.

To assist the skilled in the art in the practice of the present invention the following compositions are provided to exemplify peptizing agents of the type possessed of the capacity to maintain permanence of the intended quality and function of iron carbonyl in liquid fuels such as gasoline, benzine, and the like.

Example 1.—Equal volumes of diglycol laurate and triethanolamine oleate.

Example 2.—Ammonium oleate.

Example 3.—Ammonium oleate and oleic acid. In place of the oleic acid in this formula of peptizing agent, oleaginous materials such as sperm oil, olive oil, lard oil, and the like, may be used.

Example 4.—Ammonium stearate.

Example 5.—Ammonium stearate and oleic acid.

Example 6.—Triethanolamine oleate.

Example 7.—Triethanolamine oleate and oleic acid.

According to the present invention, it is the concept to prepare an anti-knock treating composition by blending the iron carbonyl with the peptizing agent adapted to insure permanence of quality, then treat the gasolines selected for improvement with this material, either in batches or continuously. In compounding any of the peptizing agents with iron carbonyl, they may be employed in amounts equal to from 5 to 200% of the iron carbonyl used by volume. The iron carbonyl, which is itself a liquid, may be employed in amounts equal to from 0.1 to 50 cc. per gallon of liquid motor fuel. A preferred range would be from 1 to 10 cc. of iron carbonyl per gallon of liquid motor fuel.

It will be understood, of course, that the proportion of iron carbonyl to be used in any liquid motor fuel will depend upon the properties of the base fuel itself. In general, the lower the octane rating of the base fuel, the larger should be the proportion of iron carbonyl added thereto. In the case of Michigan gasolines having an octane rating of about 50, for instance, I have found that the addition of from 5 to 8 cc. of iron carbonyl per gallon of gasoline raises the octane rating up to about 70.

From the point of view of method, the blend composition is introduced into the gasoline, which then is agitated or stirred appropriately to insure uniformity of distribution in the admixture, after which the fuel is ready for use. The iron carbonyl may be initially obtained in the form of a solution of the iron carbonyl in a petroleum distillate such as kerosene, or the iron carbonyl may be dissolved directly into the gasoline and the soap or soap-like composition immediately added thereto. A preferred method, however, is to dissolve the soap or soap-like composition into a small proportion of gasoline and add the iron carbonyl thereto. The resulting solution of the iron carbonyl and soap, or soap-like composition, in the gasoline can then be added in the desired proportions to the base fuel.

The following will serve to illustrate this procedure:

2 lbs. of ammonium oleate, or of ammonium oleate and oleic acid, are dissolved in gasoline and made up to 1 gallon. To this is added 1 gallon of iron carbonyl dissolved in kerosene in equal proportions by volume. The desired number of cc. of the resulting prepared mixture can then be added to each gallon of the base fuel to be treated. The addition of 20 cc. of such prepared mixture per gallon of gasoline having a 50 to 60 octane rating will be found to improve the gasoline to such an extent that it may be satisfactorily used in a high compression motor. The term "high compression motor" is here used as indicating an internal combustion engine having a compression ratio of at least 6 to 1 or higher.

If desired, the iron carbonyl may be admixed with the peptizing agent to provide an anti-knock "compound" for incorporation with particular batches of gasoline, for example. Care must be taken in the handling of iron carbonyl in view of the fact that it is subject to degradation upon prolonged exposure to light and air.

While the term "iron carbonyl" has been used throughout the specification and claims, it will be understood that iron pentacarbonyl is meant.

Having described my invention, I claim:

1. A liquid motor fuel, comprising a base fuel having iron carbonyl dissolved therein and containing a mixture of a soap and a substance selected from the group consisting of soap forming fatty acids and polyhydric alcohol esters of fatty acids.

2. Anti-knock gasoline comprised of relatively low octane value gasoline, iron pentacarbonyl, and a peptizing agent comprised of a mixture of fatty acid derived from a fat and a substance selected from the group which consists of ammonium oleate, ammonium stearate, diglycol laurate and triethanolamine oleate.

3. A liquid motor fuel, comprising a low compression fuel having dissolved therein iron carbonyl and a mixture of a soap and a fatty acid derived from a fat as a stabilizing and protective agent therefor.

4. A liquid motor fuel, comprising a low compression gasoline having dissolved therein iron carbonyl and a mixture of a substituted ammonium compound of a fatty acid and a soap forming fatty acid.

5. A liquid motor fuel, comprising a low compression gasoline having dissolved therein iron carbonyl and a mixture of triethanolamine oleate and a fatty acid derived from a fat.

6. The method for providing a stable, high anti-knock gasoline fuel, which method comprises treating gasoline of low octane value with iron pentacarbonyl and a peptizing agent which is adapted to maintain the iron carbonyl in the gasoline as iron carbonyl and which is comprised of a mixture of a fatty acid plus a soap of a fatty acid derived from a fat.

7. The method of making a stable high octane value engine fuel from low octane value gasoline, which method consists in dissolving in low octane value gasoline, a mixture of iron carbonyl, soap forming fatty acid, and fatty acid soap, in which mixture the amount of fatty acid plus fatty acid soap equals approximately 5% to 200% of the iron carbonyl, by volume.

8. An anti-knock fuel comprised of relatively low octane value gasoline, iron carbonyl sufficient in amount to increase the octane value of the gasoline and a composition possessing the capacity to stabilize the iron carbonyl in the gasoline comprising a soap of a fatty acid and a fatty acid derived from a fat.

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